Rec. West. Aust. Mus. 1982, 10 (1): 35-45

Variation in *Pseudechis australis* (Serpentes: Elapidae) in Western Australia and Description of a New Species of *Pseudechis*

L.A. Smith*

Abstract

Pseudechis australis (Gray) and *P. butleri* sp. nov. from Western Australia are described and their distributions are mapped. The substantial variation in *P. australis* is analysed and the relationships of *P. butleri* are discussed.

Introduction

Some of Boulenger's generic concepts for Australian elapid snakes have stood the test of time better than others. There is general agreement amongst herpetologists today that his concept of *Denisonia* (1896) was too broad, although there is still disagreement about the generic position of species removed from *Denisonia (sensu* Boulenger) (Storr 1981).

On the other hand Boulenger's concept of *Pseudechis* (1896) has changed little over the last 85 years. In fact much of the literature pertaining to *Pseudechis* stems from authors with short series of specimens at their disposal describing variants of species, particularly the widely distributed *P. australis*. Boulenger (1896: 328) recognized eight species of *Pseudechis: australis* (Gray, 1842), *cupreus* sp. nov., *darwiniensis* Macleay, 1878, *ferox* (Macleay, 1881) *microlepidotus* (McCoy, 1879), *papuanus* Peters and Doria, 1878, *porphyriacus* (Shaw, 1794) and *scutellatus* Peters, 1867. *Pseudechis colletti* Boulenger, 1902, *P. guttatus* De Vis, 1905, *P. denisonioides* Werner, 1909, *P. mortonensis* De Vis, 1911, *P. platycephalus* Thompson, 1933 and *P. wilesmithii* De Vis, 1911 have subsequently been described.

Kinghorn (1923) removed *P. scutellatus* from *Pseudechis* and erected *Oxyuranus* for it. Thompson (1930) synonymized *cupreus* and *darwiniensis* with *australis* and later described *platycephalus*.

Mack and Gunn (1953) synonymized *mortonensis* with *guttatus* and *P. wilesmithii* De Vis with *O. scutellatus,* the latter being foreshadowed by Longman (1913).

McKay (1955) transferred *P. platycephalus* and *P. denisonioides* to the synonomy of *australis,* the latter first being suggested by Glauert (see Loveridge 1934: 282).

Kinghorn (1955) merged *ferox* with *microlepidotus* and erected *Parademansia* for it. Until recently *O. scutellatus* and *P. microlepidota* were treated conspecifically, the latter being considered an inland form of the other. Covacevich and Wombey (1976) have shown them to be distinct species. Covacevich *et al.* (1981) treat the two species as congeners.

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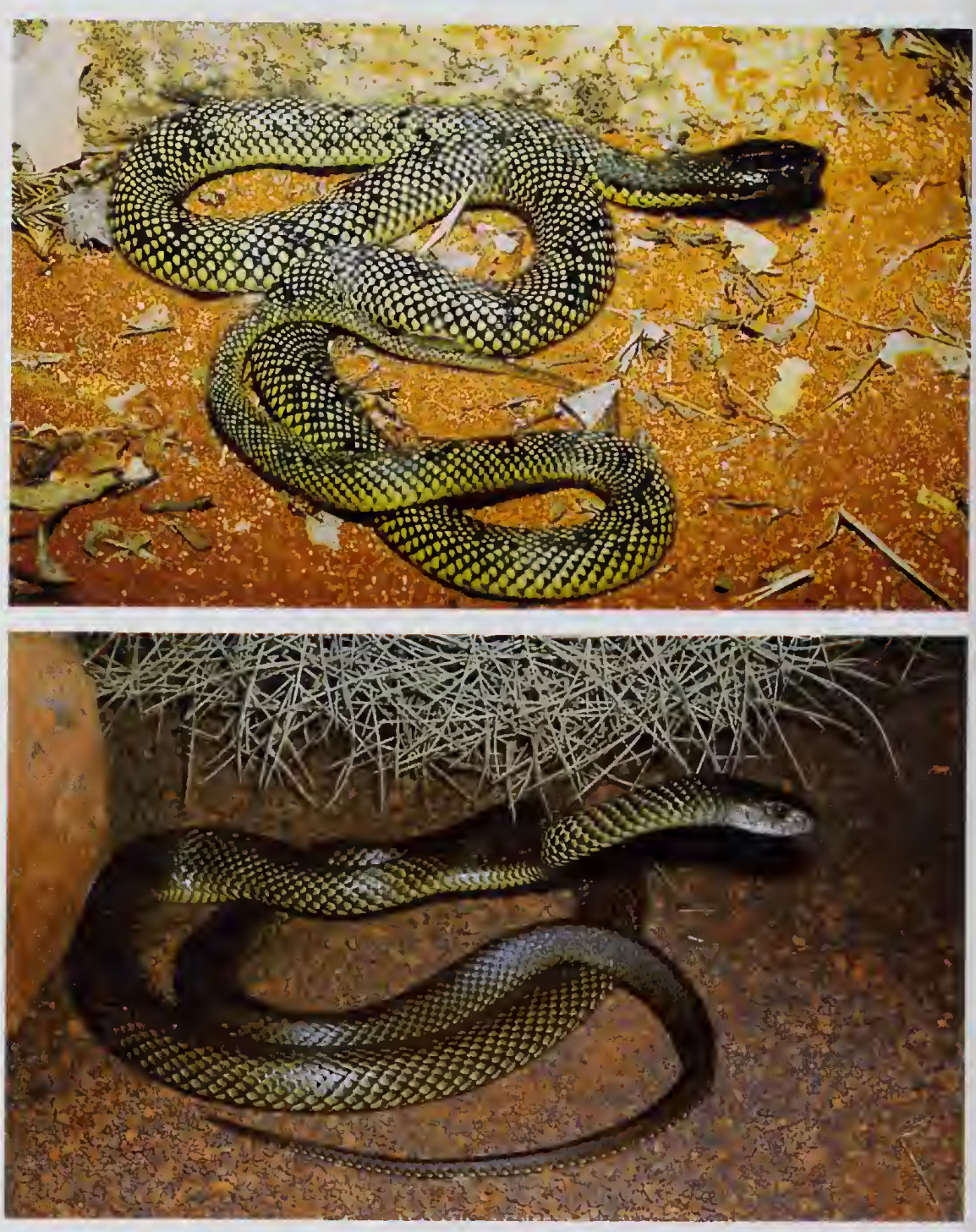

Figure 1 Top: A *Pseudechis butleri* from near Sandstone. Photographed by S. Wilson. Bottom: A *Pseudechis australis* from Nita Downs. Photographed by R.E. Johnstone.

The unique specimen of *Denisonia brunnea* Mitchell (1951) is considered here to be a *P. australis* possessing two traits unusual for that species. The lower primary temporal is contacting the lower postocular and all subcaudals are divided.

Data for eastern Australian species of *Pseudechis* are taken from McKay (1955).

The 213 specimens of *P. australis* and 21 specimens of *P. butleri* examined are lodged in the Western Australian Museum herpetological collections (R Series).

Scale rows at neck and tail were counted at the first and last ventral respectively. Bilateral characters such as temporals were counted on both sides of the head.

Systematics

Pseudechis australis (Gray, 1842)

Naja australis Gray, 1842. The zoological miscellany: 55. Type locality NE Australia.

Pseudechis darwiniensis Macleay, 1878, Proc. Linn. Soc. N.S.W. **2:** 221. Type locality Port Darwin, Northern Territory.

Pseudechis cupreus Boulenger, 1896, Catalogue of the snakes of the British Museum (Natural History) **3:** 329. Type locality Murray River.

Pseudechis denisonioides Werner, 1909, Die Fauna Südwest-Australiens **2** (16): 258. Type locality Eradu, Western Australia.

Pseudechis platycephalus Thompson, 1933. Proc. zool. Soc. Lond. 1933: 859. Type locality East Alligator River, Northern Territory.

Denisonia brunnea Mitchell, 1951, Rec. S. Aust. Mus. **9:** 551. Type locality Mt Wedge, Eyre Peninsula, South Australia.

Diagnosis

Distinguished from *P. butleri* by its colour, particularly the ventrals which are cream with a reddish-brown base (yellow with a black base in *P. butleri*). *Pseudechis australis* from the same latitudes as *P. butleri* usually have fewer ventrals (189-207 v. 204-216). Lack of crimson or pink pigment on ventrals distinguishes *P. australis* from *P. porphyriacus* (the only other *Pseudechis* species with 17 midbody scale rows).

Description

A very large snake (up to 201 cm total length). Tail 13.5-22.2% of SVL (N 47, mean 17.8). Head slender and neck indistinct in small specimens; head broad and neck moderately distinct in large specimens. Canthus rostralis prominent.

Rostral 1.1-2.1 times as wide as high (N 147, mean 1.5). Frontal 1.1-1.9 times as long as wide (N 160, mean 1.5). Nasal completely divided; in contact with the preocular (97% of specimens). One preocular, two postoculars. Primary temporals 2, the lower wedged deeply between the fifth and sixth labials and separated from the lower postocular (66% of specimens). Secondary temporals 2. Upper labials 6, third and fourth entering orbit. Lower labials 6, second smallest, fourth largest. Two pairs of chin shields, anterior pair always in contact, postocular separated (97% of specimens).

Ventrals 185-220, lowest in south, highest in north (N 170, mean 201.6). Anal rarely single. Subcaudals 50-78 (N 158, mean 58.6), percentage of undivided subcaudals 35.7-100 (N 158, mean 69.0). Sum of ventrals plus subcaudals 236-295 (N 144, mean 258.4). Midbody scale rows 17; scale rows at neck 17-24 (mostly 19); scale rows at tail 13-18 (mostly 17).

Head and neck black, blackish-brown or brown. Dorsal scales black, blackish-brown or brown, rarely without a cream or brown anterior spot. Scales on lower flanks with more pale pigment than those dorsally. Chin, throat and belly cream, base of each ventral reddish-brown (Figure 1).

Iris brick red. Mouth pink or pinkish-grey.

Distribution

In Western Australia from the far north south to Upper Swan, Yornaning, Marvel Loch, Kalgoorlie, Naretha, Haig and Forrest. Also Sir Graham Moore, Cockatoo, Koolan, Rosemary, Barrow, Bernier, Dorre and Dirk Hartog Islands (Figure 2).

Geographic Variation

The sample was divided into 10 classes of latitude (one class for every 2°), and ventrals, subcaudals, and percentage of undivided subcaudals were analysed (see Table 1).

South of 19°S ventrals and sum of ventrals plus subcaudals vary clinally with latitude. North of 19°S the cline is interrupted. Kimberley specimens have on average more undivided subcaudals and slightly longer tails (Kimberley specimens 14.9-22.2% SVL, mean 19.1, south of Kimberley 13.5-20.1% SVL, mean 18.3). The nasal is separated from the preocular only in the Kimberley (16.6% of specimens). At first these differences seemed to correlate with the Kimberley colour form (see below). However, some of the Kimberley and North-West Division specimens with relatively short tails and few undivided subcaudals have some markings on the head.

The lower primary temporal contacts the lower postocular most frequently in the south (43.3% in the South-West Division, 35.4% in the Eastern Division, 33.6% in the North-West Division and 10.3% in the Kimberley Division).

Overall dorsal colour of a specimen varies with three factors:

(a) colour of pale anterior spot on each scale which varies from cream to brown (spot absent when scales are wholly black);
(b) colour of apex of each scale which varies from brown to black;
(c) size of pale anterior spot relative to the whole scale which varies from zero (when scale is wholly black) to more than half the scale.

An attempt at analysing this variation was made by scoring, for individuals, the colour of their mid-dorsal scales and placing the evaluation into one of three categories for (a) and (b) above and expressing the proportion of pale anterior spot relative to a whole scale as one of three conditions for (c) above. Thus:

Score	Colour of anterior spot	Colour of scale apex	Area of pale spot
1	cream	brown	>½ scale
2	brown	blackish-brown	½ scale
3	spot absent (scales wholly black)	black	<½ scale

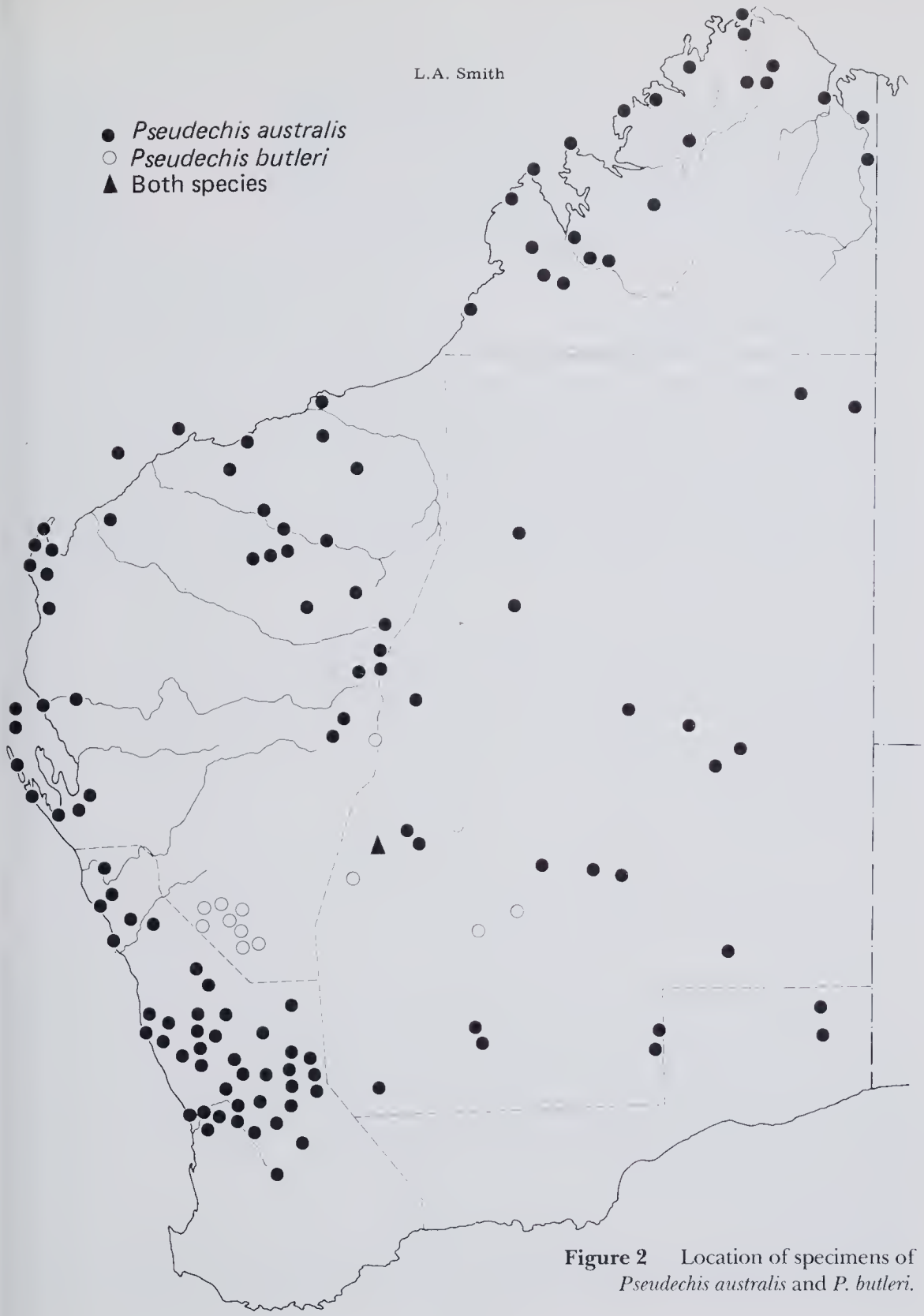

Figure 2 Location of specimens of *Pseudechis australis* and *P. butleri*.

Results indicated that some colour variations had fairly precise geographic boundaries, otherwise colour types at best can only be described as predominating in (but not being confined to) particular areas.

Large anterior spots tend to be cream and cream anterior spots generally precede brown apices (giving an overall impression of a pale snake). Brown anterior spots are usually small and precede blackish-brown or black apices (giving an overall impression of a dark snake).

Darkest specimens occur south of a line joining Jurien Bay, Badgingarra, New Norcia and Quairading. Here the anterior spot is brown or absent (not cream). Only a few specimens have all black dorsals.

Colour of Kimberley specimens is distinctive for two reasons. Firstly, contrast between anterior spot and darker apex of a scale is greatly reduced. Scales are a fairly even brown or slaty grey. Secondly, sutures of head shields, particularly those between parietals, are dark brown. There are also dark spots and flecks on head shields themselves. Juveniles also have three longitudinal stripes (vertebral and dorsolaterals) which begin on the nape and extend a short distance posteriorly. Head and nape markings reduce with age and are usually absent on large adults, the parietal suture mark persisting longest.

Specimens from the vicinity of North West Cape tend to have scales with large cream anterior spots and blackish-brown or black apices, giving specimens a reticulated pattern.

Specimens from eastern areas (Gibson and Great Victoria Deserts and Nullarbor Plain) tend to have scales with a small cream anterior spot and the remainder of scale very dark brown, giving specimens a freckled appearance. Two of these specimens had dark freckling on the belly.

Apices of scales on Cockatoo Island specimens are a distinctive rich reddish-brown and the anterior spot is cream.

Individual Variation

So far meristic data have been arranged to elucidate geographic variation which masks individual variation. The large sample examined included several series from single localities which indicate the extent of individual variation. Range for characters in Table 1 for a series of 5 from Ilgararie Creek was: ventrals 195-212, subcaudals 53-60, sum of ventrals plus subcaudals 248-272 and percentage of undivided subcaudals 62-77%.

Series from Kalumburu (Kimberley Division), Warburton Range Mission (Eastern Division) and Kellerberrin (South-West Division) show similar variation. Greatest variation in percentage of undivided subcaudals was at Kalumburu (49-100%).

The lower primary temporal was fused to the last labial on one side in two specimens. The third upper labial was divided into 3 on one side of one specimen. Last two upper labials were fused on one side of one specimen, and the upper primary and secondary temporal were fused to the parietal on one side of another specimen. One or three secondary temporals are rare.

Material Examined

Kimberley Division

Sir Graham Moore I. (44127); Kalumburu (21853, 28080, 42794); 14 km SSE of Walsh Point (61729); Mitchell Plateau (58318); Drysdale River National Park in 15°02°S, 126°55'E,

15°08′S, 127°06′E and 15°03′S, 126°44′E (50334, 50459 and 50542 respectively); Forest River Mission (12496); Prince Regent River Reserve in 15°07′S, 125°04′E and 15°48′S, 125°20′E (47041-42 and 46896 respectively); Kuri Bay (22778, 22925); Kimberley Research Station (9994, 14487); Kununurra (20569-70); 13 km SE of Kununurra (23106); Cockatoo I. (14073, 14141, 15830, 31959); Koolan I. (29140); Wotjulum (11243, 11722); Lake Argyle (44787, 52666, 70717); 10 km W of One Arm Point (60909); Beagle Bay (3802); Inglis Gap (28077); Yeeda (29722); Broome-Derby road (13846); Camballin (26780); Mt Anderson (58616-17); McHugh Bore (53882); Dampier Downs (58552); LaGrange (28075).

North-West Division

Rosemary I. (41001); DeGrey Station (5106); Carlindi (15067); Barrow I. (28696-98, 48958); Pyramid (25669-70); Marble Bar (13688); 112 km W of Woodstock (28076); 22 km SE of Onslow (22957); Vlaming Head (14012, 19673); Yardie Creek (56129); presumably Exmouth (31420); Wittenoom (11445, 18492); 4 km S of Mt Bruce (69569); 32 km E of Mt Bruce (69571); near Tom Price (31019-20); Ningaloo (32039); 32 km E of Point Cloates (25658); Weeli Wolli (22728); Mt Newman (26438); 14 km SE of South Hill (63811); Turee Creek (17693, 22735); Mundiwindi (19205, 45090); Ilgararie Creek (22721-25); 10 km N of Kumarina (22731-32); 16 km SE of Kumarina (25151); Carnarvon (13472, 32023); Carnarvon area (25830); Meeragoolia (64702); Bernier I. (34092, 64433); Dorre I. (13475, 64875); 37 km W of Neds Creek HS (22727, 25208); 5 km SW of Mt Leake (25209); Dirk Hartog I. (10294, 42397); 3 km SW of False Entrance Well, Carrarang (54730); 19 km E of Hamelin HS (14935); 9 km N of Coburn (66294); Tamala (6519, 6521).

Eastern Division

3 km SW of Lens Bore (63356-57); McGuire Gap (63271); Rudall River (40701); 13 km N of Well 17, Canning Stock Route (31323); 16 km N of Beyonde (21527); Carnarvon Range (51917); south end of Carnarvon Range (53647); 30 km E of Everard Junction (22815); 52 km WSW of Everard Junction (60097); Warburton Mission (22073, 22178, 31350-53); presumably Warburton Mission (22003); 48 km SW of Warburton Mission (28989); Albion Downs (30981); Yakabindie (24691); Booylgoo Spring (1179); Cosmo Newbery (13851, 13853); 30 km N of Neale Junction (48755); 27 km E of Point Sunday (53543); 8 km W of Yamarna HS (28789); 26 km N of Kalgoorlie (15608); Kalgoorlie (61623); Burbidge (29489); Marvel Lock (23329); Naretha (14936); 59 km of WNW of Rawlinna (41228).

Eucla Division

19 km SE of Lake Gidgie (39067); 176 km N of Haig (43903); 58 km N of Forrest (14104).

South-West Division

30 km E of Kalbarri (36465); Balla (26011); presumably Binnu (24856); 11 km E of Hutt River mouth (28079); East Chapman (4449, 4523); Tenindewa (44551); Geraldton (8594); Bowgada (6325); Bunjil (52107); 10 km SW of Eneabba (30306); 16 km E of Green Head (28331); Wubin (12928); 19 km E of Wubin (26202); Gunyidi (6141); 16 km ENE of Jurien Bay (46133); 10 km E of Jurien Bay (60516); Jurien Bay (42380); Namban (21571); 7 km NW of Badgingarra (32082); Badgingarra (17113-14); presumably Badgingarra (21833); presumably Coomberdale (24846); Kulja (5169, 6276); Bindi Bindi (28400); Moora (24991); Moora Shire (34346); presumably Moora area (26080-81); 8 km S of Moora (43922); 20 km W of Dandaragan (59973); 45 km N of Beacon (48390); Bencubbin (5089); 15 km W of Koorda (37886); Wongan Hills (9763, 59973); Mukinbudin area (34702); Moonijin (5520); New Norcia (59979); Bullsbrook (71868); Mangowine, via Nungarin (7852, 7859); Konongorring (12487); Trayning (45975); 48 km E of Dowerin (29490); 16 km S of Calingiri (14662); Goomalling (10767); 8 km S of Bolgart (17089); Bejoording (9775, 10053); Merredin (18502, 22297); 25 km N of Kellerberrin (56542); Baandee (3365, 9988); Kellerberrin and vicinity (22728, 26549-50, 24878, 25973); 19 km NW of Northam (20583); Cunderdin (32000); 10 km E of Northam (24089); Upper Swan (5163); 13 km W of York (22900);

Table 1 Geographic variation in ventrals, subcaudals, ventrals plus subcaudals and percentage of undivided subcaudals in *Pseudechis australis*.

Latitude South		Ventrals	Subcaudals	Ventrals plus subcaudals	Percentage subcaudals undivided
	N	5	4	4	4
13-15°	range	200-217	63-71	263-279	49.2-100
	mean	207.0	66.5	272.0	82.3
	N	21	16	15	16
15-17°	range	196-220	53-78	259-295	54.2-100
	mean	206.7	65.5	274.9	81.7
	N	7	6	6	6
17-19°	range	196-201	57-63	255-262	57.8-91
	mean	198.0	59.1	257.1	70.2
	N	7	8	7	8
19-21°	range	204-216	54-65	258-279	45.4-76.9
	mean	209.0	58.7	268.4	66.0
	N	17	17	17	17
21-23°	range	198-213	53-64	258-279	50-85.7
	mean	208.5	59.1	267.5	69.1
	N	22	20	19	19
23-25°	range	201-213	53-72	248-276	46.2-100
	mean	206.3	57.7	264.1	67.8
	N	19	17	16	17
25-27°	range	196-209	50-69	254-274	50.7-93.2
	mean	203.0	59.1	262.5	67.9
	N	13	9	8	9
27-29°	range	189-204	51-61	234-267	54-100
	mean	197.4	57.0	251.9	68.0
	N	30	29	25	29
29-31°	range	185-206	51-59	238-262	35.7-96.2
	mean	194.5	55.4	250.2	66.5
	N	29	32	27	33
31-33°	range	186-205	50-61	236-263	45.8-81.8
	mean	196.2	57.7	252.3	65.4

7 km SW of York (23341); York area (10559); Quairading area (31321); 13 km E of Quairading (52271); Beverley (68999); presumably Beverley area (23825); Corrigin (64625); 25 km E of Yornaning (50161, 56887).

Northern Territory

Yirrkala Mission (13525); Adelaide River (9986); Katherine (13982, 16505, 21590, 24930, 26348); 34 km SW of Borroloola (32063); 96 km W of Roper River mouth (32064); Kildurk (36333); 3 km S of Elliott (47689); 64 km N of Tennant Creek (34011); 'Tennant Creek' (21514-16).

Pseudechis butleri sp. nov.

Holotype

R22345 a gravid female (SVL 93 cm) collected 19 km SE of Yalgoo, Western Australia, in 28°29′S, 116°49′E, by I.C. Carnaby on 15 October 1963.

Paratypes

North-West Division

New Springs (13703); Wurarga (5372, 7395); Yalgoo (7472); 3 km S of Yalgoo (29232); 48 km S of Yalgoo (12919); 56 km S of Yalgoo (25815); Muralgarra (8177); Barnong (25978); Thundelarra (34694); Fields Find (R13555, 13667); Warriedar (1329).

Eastern Division

Wonganoo (51101); Booylgoo Spring (1519, 1380, 7627); 8 km W of Laverton (44550); Laverton (22395); Mt Malcolm (10701).

Diagnosis

Distinguished from *P. australis* by its colour, particularly the ventrals which are black-based and bright yellow in *butleri* (cream with a reddish-brown base in *australis).* Further distinguished from *P. australis* (from the same latitudes) by usually having more ventrals (204-216 v. 189-207). *Pseudechis porphyriacus* of eastern Australia has fewer ventrals (175-210, mean 186.3) and black-based crimson or pink ventrals.

Description

A large snake (up to 156 cm in total length). Tail 13.9-16.4% of SVL (N 4, mean 15.2). Head broad and moderately distinct in large specimens. Canthus rostralis prominent.

Rostral 1.3-2.0 times as wide as high (N 20, mean 1.6). Frontal 1.1-1.5 times as long as wide (N 19, mean 1.2). Nasal completely divided; in contact with the preocular (98% of specimens). One preocular, two postoculars. Primary temporals 2, the lower wedged deeply between the fifth and sixth labials and separated from the lower postocular (95% of specimens). Secondary temporals 2. Upper labials 6, third and fourth entering orbit. Lower labials 6, second smallest, fourth largest. Two pairs of chin shields, anterior pair always in contact, postocular pair separated (95% of specimens).

Ventrals 204-216 (N 15, mean 211.4). Anal divided. Subcaudals 55-65 (N 16, mean 58.6), percentage of undivided subcaudals 35-76 (N 15, mean 59.6). Sum of ventrals plus subcaudals 268-279 (N 15, mean 270). Midbody scale rows 17; scale rows at neck 16-23 (mostly 19); scale rows at tail 15-18 (mostly 17).

Rostral, nasals, preoculars, labials (except for a short black subocular streak bordering orbit), chin shields and gulars reddish-brown. Remainder of head and nape black with a reddish-brown tinge. Reddish-brown head and neck most prominent in juveniles. Back with irregular groups of all-black scales. Remainder of dorsals black with yellow (rarely brownish) centres. Most yellow is present on scales of lower flanks (black apices), least mid-dorsally (small yellow spots with broad black margins). Ventral surface bright yellow, base of each ventral always unevenly edged black, remainder of ventrals sometimes flecked black (Figure 1).

R7627 arrived at the Western Australian Museum freshly dead. Glauert (1957: 32) described its lighter parts as 'primrose yellow'.

Distribution

Arid mid-west of Western Australia north to New Springs, south and west to Barnong and east to vicinity of Laverton (Figure 2).

Remarks

Glauert (1957: 31) suspected that *P. butleri* was a new taxon but was loath to place a name on a small series. He was not aware that much of the extensive variation in *P. australis* was clinal which prevented him from discovering meristic differences between the two species. That *P. australis* can be very dark (sometimes black) dorsally in the extreme south-west of its range further obscured the situation.

The distinctiveness of *P. butleri* becomes apparent when its meristics are compared with those of *P. australis* from similar latitudes (25°-28°S):

		Ventrals	Subcaudals	Ventrals plus subcaudals	Percentage subcaudals undivided
P. australis	N	32	26	24	26
	range	189-207	50-69	238-267	52.2-100
	mean	201.0	58.3	260.3	64.7
P. butleri	N	15	16	15	15
	range	204-216	55-65	268-279	35-76
	mean	211.4	58.6	270.0	59.6

Pseudechis australis with all-black scales do not occur in these latitudes.

Of the other species of *Pseudechis (australis, colletti, guttatus, papuanus* and *porphyriacus) butleri* is most like *porphyriacus* in having 17 midbody scale rows and a similar colour pattern. Cogger (1979: 396) says *porphyriacus* often has a light brown snout, while McKay (1955: 18) mentions specimens... 'with a few crimson scales scattered on the dorsal surface...' In *butleri* the rostral and lateral head shields are reddish-brown and yellow pigment is always present on most dorsal scales. Thus despite obvious differences in the colour of non-black areas of scales, the two species' patterns are similar, the difference depending on the extent of black pigment.

Like other Australian 'black snakes' *(P. colletti, guttatus* and *porphyriacus) butleri* is not widely distributed compared with *P. australis*, which is found in all but extreme southern parts of Australia (see Cogger 1979: 395). These relatively localised, disparate distributions of the black snakes suggest that *P. australis* may have expanded its range at their expense.

This species is named after Mr W.H. Butler CBE in recognition of his efforts for the cause of conservation in Australia.

Acknowledgements

I am grateful to Dr G.M. Storr, Head, Department of Ornithology and Herpetology, for comments on the manuscript, to Mr S. Wilson for the photograph of *P. butleri* and to Mr R.E. Johnstone for the photograph of *P. australis*.

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Received 31 July 1981 Accepted 22 February 1982 Published 30 June 1982